UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr.:
LIMITED

E/ECA/NRD/ESDP/8
9 December 1985

Original: ENGLISH

ECONOMIC COMMISSION FOR AFRICA

Regional Workshop on Energy Supply and Demand Projections through 1985-1990 in Africa

Addis Ababa (Ethiopia), 25-29 November 1985

LC/NAIROBI.

REPORT

REGIONAL WORKSHOP ON ENERGY SUPPLY AND DEMAND PROJECTIONS THROUGH 1985-1990 IN AFRICA

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PART ONE - Attendance and Organization of Work

Opening and duration of the meeting (Agenda item 1)

1. The Regional Workshop on Energy Supply and Demand Projections through 1985-1990 in Africa was held at the Headquarters of the United Nations Economic Commission for Africa, Addis Ababa, from 25 to 29 November 1985. The Workshop was opened by Professor Adebayo Adedeji, United Nations Under-Secretary General and Executive Secretary of ECA.

The opening address

2. After welcoming the participants, the Executive Secretary expressed his appreciation to the Governments and the organizations and the institutions represented at the meeting for their response to his invitation. He then outlined the main objectives of the workshop which were to form the basis for the deliberations.

3. He said the major emphasis of this workshop was laid on self-reliance of member States in solving the problems of short-term forecast of energy production and consumption in Africa. The key objective was to review the existing projections of energy supply and demand through 1985-1990 in Africa.

4. One of the objectives of the workshop was the strengthening of the African member State's management and control of their energy resources in line with their development aims in order to enable them to appraise energy demand and supply options and to achieve strategic energy planning by supporting energy programming and providing technical assistance for departments responsible for the planning and execution of energy policies. The objectives included the identification of future avenues for co-operation among African States for perfection of the existing methods of energy supply and demand projections.

5. He stressed that the most important component of energy resources development was energy planning which should lead to a rational choice of energy demand and supply systems that are consistent with the country's economic and industrial development objectives both short-term and long-term.

6. He further emphasized the importance of energy in economic development and growth and said that energy was the lifeblood of modern life so much so that per capita energy consumption of a country was a key indicator of its stage of development. A direct correlation existed between energy consumption and economic growth. Hence it was normal and necessary that African nations should seek adequate, secure and reasonably

economical sources of energy. However, energy problems remained serious in African countries and that despite a recent weakening in world energy prices shortages in energy supply in Africa were particularly still critical.

7. The Executive Secretary drew attention to the severe economic and social crisis currently facing Africa and the measures adopted for dealing with it which called for earnest contributions from everyone. He expressed his expectation that the workshop would relate closely to the existing economic and social situation in the region. The solution to a lot of the problem highlighted therein would demand appropriate energy planning as an integral part of overall economic development planning. However, he continued that a mere adoption of policies and even plans was not a sufficient measure unless supported by appropriate institutional infrastructures and policy instruments necessary for their implementation. He concluded his address by reiterating the importance of the energy sector and invited participants to explore the possibilities of evolving joint schemes to address the current and future issues. He was confident that the conclusions and recommendations of the workshop would contribute significantly to the strengthening of the capabilities in energy policy and planning in the African region.

Attendance

8. The following member States of the United Nations Economic Commission for Africa were represented at the meeting: Angola, Burundi, Egypt, Ghana, Côte d'Ivoire, Lesotho, Libya, Malawi, Rwanda, Zaire.

9. The following member States of the United Nations were also represented by observers: Finland, German Democratic Republic, Turkey, Sweden and United Kingdom.

10. Representatives of the following United Nations bodies and specialized agencies participated in the meeting: United Nations Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), United Nations Secretariat, (DIESA) and United Nations Centre for Human Settlements (Habitat).

11. The following intergovernmental organizations and specialized technical agencies were also represented: The Organization of African Unity (OAU), the European Economic Community (EEC), Swedish International Development Authority (SIDA), ENDA, IDRC and IEA.

Election of Officers (Agenda item 2)

12. The following were elected to the Bureau: Mr. Shawky Farid M. Arafa (Egypt) as Chairman, Mr. Anguie Anguie (Ivory Coast) and Mr. Ossay Nawa Leba (Zaire) as Vice-chairmen, Mr. B. Kanetsi (Lesotho) and Mr. Isaac Mintah (Ghana) as Rapporteurs.

Adoption of the Agenda (Agenda item 3)

13. The following agenda was unanimously adopted:

1. Opening of the Workshop,
2. Election of Officers.
3. Adoption of the Agenda and Organization of work,
4. Consideration of the document "Energy Supply and Demand Projections through 1985-1990 in Africa".
5. Petroleum Supply and Demand Projection in Africa,
6. Coal Supply and Demand Projections through 1985-1990 in some Southern African member States,
7. The Situation of the Electric Energy Supply and Demand during 1972-1982 and the Future Perspectives in Africa,
8. Evaluation of Energy Demand in developing countries: the MEDEE-S Model,
9. Consideration of the national papers and papers prepared by International Organizations,
10. Consideration and adoption of the recommendations and the final report of the Workshop,
11. Any other business,
12. Closure of the Workshop.

PART TWO - Account of proceedings

Energy Supply and Demand Projections through 1985-1990 in Africa (Agenda item 4)

14. The representative of the secretariat presented document E/ECA/NRD/ESDP/4 entitled "Energy Supply and Demand Projections through 1985-1990 in Africa". In highlighting the contents of the document the meeting was informed on issues of energy resources such as: energy reserves in Africa, its production and consumption both in the areas of commercial and non-commercial energy. The importance of policy and the need for systematic planning was described as a valuable tool for future development of energy resources. The representation was made by making reference to tables and figures on production and consumption and the projection to future development trends of energy resources. To stimulate discussion, the attention of participants was drawn to some critical questions that needed to be examined in the areas of production and use of energy resources in Africa and its impact on industrial development.

15. During the course of discussion, a number of observation and remarks were made by participants. One of the issues in which concern was expressed related to the question of developing nuclear power in Africa which in the document was expressed to constitute one percent of the energy resources in Africa. This energy resource which was indicated to have been considered for development in Egypt, Algeria, Libyan Arab Jamahiriya, Nigeria and Gabon was commented upon as very insignificant and apparently of minor importance in terms of its impact on the region's energy requirement. In responding to the above remark,

attention was called that Africa cannot be left in isolation from the rest of the world in taking advantage of recent developments such as nuclear energy and that steps should be taken in this regard before it is too late. As regard the scale of development, it was stated that this will build-up in due course once the development starts.

16. Another point which was raised, related to whether or not it would be necessary to critically examine the need for development of coal energy in Africa. This concern was expressed because of the recognition of the fact that many developed countries are abandoning plants which depend on coal energy, and that given such a situation Africa would be a loser in the game. In this connexion it was pointed out that even if the decision is to develop coal resources, there is a further constraint, imprecise knowledge of extent of the coal reserve in Africa. To support this statement, attention was drawn to the remarkably low estimate of coal reserve which was given in the document under consideration as against those presented by the secretariat in 1984. On basis of this situation, a query was made as to whether in the first instance, an inventory should not be made to procure data on the coal reserves in Africa. In pursuing the view against developing coal energy, an opinion was expressed indicating that exporting the coal reserve to other regions which already have plants depending on coal energy, rather than taking the risk of establishing outmoded and obsolete plants would be a profitable preference to Africa.

17. In responding to the above remarks, a member of the secretariat expressed agreement to the statement made regarding the observation on the discrepancy that existed between the figures given in the documents that originated from the secretariat in 1984 and 1985. It was explained that essentially the figures in both cases were procured from the same documented sources except that the figures were up-dated from time to time which explained the reason for the variation. The task of establishing a reliable inventory of energy resources was said to be constrained primarily by lack of data. Further, it was revealed that the reliability of whatever data is available remains questionnable since it is more often than not taken from foreign sources, whose primary interest may not focus on development in Africa and who may not be interested to refine these data by conducting in-depth studies. Despite these difficulties, the meeting was informed that the secretariat will not save any effort to undertake the exercise of reviewing the data on a continuing basis so that reliable estimates are established on the inventory of coal reserves in Africa.

18. It was recognized that Europe would in the long-run go away from using coal-fired power stations whereas in Africa the need to develop this energy resources is considered invaluable because of the many favourable factors substantiating this consideration. The main points, in support of this view are that: (i) pricewise, coal is competitive to oil; (ii) while the situation from sub-region to sub-region may vary the fact remains that the trend in many parts show that there is a serious consequence of environmental degradation arising from an over dependence on firewood, hence the need for environmental protection deserves priority consideration by using coal as a substitute for firewood and; (iii) for many countries in the region and contrary to the situation in Europe where

the preference is to abandon coal resource and import oil, it would be advantageous for Africa to exploit the available coal resource in which there is the added advantage of skill and cheap labour for its exploitation.

19. Consideration of the benefits of development of conservation in energy at the regional and sub-regional scale was questioned in the face of the fact that current trends do not indicate any developed inter-African trade in this commodity. This statement was supported by the evidence that there are many countries in Africa producing much more energy than that which can be consumed in the region whereas on the other hand those countries not producing enough energy do not even have access to use this resource.

20. There was concurrence that the continent of Africa is producing more energy than it can consume. It was also accepted that there is no developed intra-African trade in this commodity. At the same time it was realized that in the long-term the consideration of the regional development perspective would yield good dividends by taking into account the needs at national and sub-regional levels.

21. In addition to the above observations, participants made a number of remarks to improve upon the content of the document. Among others, some of the remarks included issues concerning the need to make an assessment of the consumption of fuelwood since it is the single important source of fuel and bears significance because of its impact on the environment; that the methods of projection should be stated and that since the result is only as good as how valid and reliable the data is, it is essential to improve upon the data base; that in the context of the African situation, there should be a bias towards development of biomass, solar, thermal, liquid hydrocarbon in preference to the development of nuclear energy; that financial implication of production and consumption of energy should be reflected in the document and that the bias to giving more data on the supply side should keep balance with the demand situation.

22. Participants were assured that the secretariat would take note of all the comments made and that it will take the necessary steps to improve upon the data and thereby the contents of the document in due course.

Petroleum Supply and Demand Projection in Africa (Agenda item 5)

23. The representative of the secretariat presented document E/ECA/NRD/ESDP/5 entitled "Petroleum Supply and Demand Projections in Africa". He highlighted a growing awareness on the part of African oil producing countries, multinational oil companies and financial institutions that existing oil and gas reserves must be developed and the discovery of potential new reserves must also go ahead. There had been a welcome move towards greater realism on all sides, borne of the common understanding that despite the current lull in oil market, hard work needs to be done in Africa to secure energy resources over the long term. It was in the interest of African member States to encourage petroleum exploration, given the projected climb in their consumption, which might double by the year 2000, as they move further along the path of economic development (with population

growth, increasing urbanization and, in many subsaharan countries, diminishing supplies of traditional or non commercial sources of energy). It is in the interest of Africa's economy as a whole to provide an adequate supply of energy.

24. The present lull and relative lack of interest in petroleum activity in Africa is unlikely to last long. The majority of short-term forecasts show that demand for oil will rise slowly over next five years 1985-1990 between 1.8 and 2.3 percent per annum.

25. In order to reduce dependence on import of oil non-producing African countries should develop more prospecting and exploration of oil and natural gas for which large scale investment is necessary. Some member States leave the exploration for hydrocarbons to foreign companies or to public national companies. While exploration by private industry tends to be directed towards early economic rewards the nationally owned or parastatal enterprises may accept a long-term comprehensive programme of studies.

26. In the discussion that followed a number of observations and remarks were made by participants. Many delegations made their comments on the figures presented in this paper noting that the basic source of information is to be the member States themselves rather than UN sources which are usually three years late. Some representatives pointed out the importance of natural gas as a substitute for oil and as a feed stock for petrochemical industry.

27. The representative of the International Organizations emphasised the importance of conservation measures which could help to save energy both in industrial sector and domestic sector. Some delegations voiced their concern about weak Intra-African trade in petroleum and natural gas, stressing the point that export obligations of petroleum exporting African countries became of the first priority to them.

28. The member States stressed the importance of co-operation between member States and the sub-regional and economic organizations in the exploration, exploitation, distribution and use of petroleum and natural gas.

Coal Supply and Demand Projections through 1985-1990 in some Southern African member States (Agenda item 6)

29. The representative of the secretariat presented document E/ECA/NRD/ESDP/7 entitled "Inventory and assessment of African coal resources, production and trade in the context of regional African development".

30. He said that there were ample coal reserves in Africa in order to justify major coal developments in order to substitute environmentally destructive firewood consumption and expensive oil imports for power generation. Also the development of major coal export projects appeared to be feasible where the necessary investments for infrastructure can be kept at competitive levels.

31. The presentation explained that the Southern half of Africa possessed much more resources than the Northern part of the continent. Of specific interest and concern

appeared to be the steeply growing coal import figures for some North African countries and for Nigeria. The efforts in these countries to increase or to establish indigenous coal production were recorded. However, the much smaller reserve and resource potentials in Northern African countries did not offer too optimistic expectations. The North African countries would be the main potential intra-African coal importers for steam and coking coals. The Southern and Eastern African countries are the potential coal exporters for steam and coking coals.

32. Unfortunately, the infrastructural preconditions (rails, harbours) were inadequate and would require major investments. These, on the other hand, necessitated major quantities for coal exports in order to secure payback of these costly investments. Major quantities, however, required certain minimum technical, managerial and politico-economic conditions, which where still to improve in some of these countries.

33. The result would have to be a major effort on the side of the concerned developing countries to create the required pre-conditions, predominantly in respect of educated, trained and experienced managerial manpower, in order to co-ordinate and to monitor major coal development projects. Close co-operation with industrialized countries which may have an interest in such developments appeared to be part of the answere. Overseas coal consumers may be the group of donor and co-operation partners to be approached. This, however, should not exclude the intensified co-operation between interested African States.

34. Education and training of managerial personnel requires a long term approach. Successful examples have been established in co-operation with industrialized countries. The experiences gained by these models could be helpful for further co-operation. Also sub-regional institution building for education and training appears to be one of the required measures.

35. However, time appears to be of the essence, and a short-term appraoch can be chosen by employing experienced project - and operating managing companies in order to prevent failure and wasted resources. Mining, and specifically coal mining, requires a high degree of expertise which is not only required to safeguard a sound return on the investment, but must be regarded indispensable for the safety of the underground labour force.

36. The principle was applicable not only to large scale coal mining investment, as mainly required for the establishment of export capacities, but also - and sometimes even more - to small or medium scale mining as required for the initially mentioned purpose of wood fuel substitution and local power generation. This does not mean, however, that sophisticated, highly mechanized mining methods should be pursued for such small or medium scale underground coal mines. The very simple but effective lay out of some African underground mines shows that the operating costs appear to have been minimized by applying a minimum of investments and equipment installations. Such low cost mining, if effectively managed, can successfully compete with highly mechanized mines of similar production.

37. This complex of realistic cost optimization appeared to be of specific importance with respect to the endeavour of African countries to develop their own coal resources for indigenous consumption, for small scale power plants, and for the substitution of excessive wood fuel consumption around towns and villages, where small and medium scale coal mines would be the answer to the question of how protection from environmental devastations and relieve from expensive oil imports can be achieved.

38. In the discussion that followed the participants asked the secretariat whether ECA possesses the figures on coal for all African member States. The representative of the secretariat referred to table one and assured that the figures quoted reflected the present status of information which rendered more precise figures for those Southern African countries which had been visited, in comparison to North and Western African countries for which the figures must be regarded as preliminary. However, the orders of magnitude as gained from the quoted sources appeared to be sufficiently precise in order to demonstrate the projected coal supply and demand development in Africa including intra-African coal trade.

39. It was observed that the coal resources figures of table one differ from those as presented by ECA in 1983. ECA explained that the basis for those figures were different.

40. Later on in the discussion, the point was raised that the figures for coal production in the general paper on Energy Supply and Demand Projections did not tally with the figures as presented in table one of the inventory. ECA explained that different sources and units were used. While the first information was taken from the 1983 United Nations Energy Statistics Yearbook, and expressed in tonnes of oil equivalent, the second set of figures assembled from the information gained during recent missions to Southern African countries and from documents available in ECA was expressed in metric tonnes of coal. A reconciliation will be attempted in the final presentation in 1987, however, certain differences will prevail due to the different sources.

41. ECA believed that the information obtained in direct contact with the authorities of member States during missions may be more precise.

42. As to the opportunities of future intra-African trade, the representative of ECA outlined the anticipated development of demand in some North and Western African countries. The presentation had been restricted to the figures of actual reserves, actual and forecast production, imports and exports. Demand figures were not included since they were floating and were influenced by availability and policies. Some coal projects require a rather long lead period and were not yet visible in forecast for 1990.

43. Questions were raised about the substitution of fuel wood and charcoal by coal. In view of the lacking reliability of statistics on firewood consumption an answer was not easy. The issue had to be seen under a long-term aspects.

44. For wood substitution in households and small industries, raw coal had to be beneficiated in order to obtain an acceptable coal quality. Suitable types of stoves have to be introduced and a distribution system would be required. On the basis of heat value, coal appears to be cheaper than commercially traded firewood. However, rural African population is cutting its firewood traditionally free of charge around villages and towns. In order to substitute such consumption by coal, massive subsidization would be required in all probability if progressive desertification around human settlements was to be halted.

45. In the course of the discussion it was emphasized that coal is presently used in Africa mainly for power generation and that it would be wise also to export coal to Europe and elsewhere where the costs of coal are steeply rising due to increasing mining costs with greater depths. Some European countries have become major coal importers after having closed parts or all of their coal mines. However, ECA emphasized that coal export projects in Africa must compete in the international markets, which are oversupplied at present, and that major infrastructure must be invested before African coal can reach the ocean. Railway lines and harbours had to be upgraded or newly be established at high costs which, in return, require a large amount of coal quantities to be exported in order to secure a sufficient return on the investment.

46. Resulting were major dimensions of initial investments which African countries could afford on their own. Co-operation with coal consumers and experienced operating companies appears to offer viable solutions specifically if the available coal qualities are in demand. Exporting coal to overseas markets does not exclude, however, intra-African coal trade and indigenous consumption. The very large African coal reserves would allow the exploitation of all options.

47. It was further emphasized that power generation at the mine mouth would offer better economic solutions than transporting coal over long distances to power plants. The mine mouth power plant can burn low quality coal or even discards while the beneficiated products would be used for local consumption in industry and households or be despatched for exports.

48. The difficulties of competing with multinationals in the international coal markets were emphasized. The suggestion was to consider co-operative solutions because the large amounts of investments required could only be mobilized by international co-operation. On the other hand the long term prospects for participating in the international coal markets appear to be good because of steeply growing demand. The example of Columbia was mentioned where a mega coal project, El Cerrejon, was initiated during recent years in a joint venture between the Columbian Government and a multinational company which was successfully operating the mine, preparation plant, railway and harbour and did, in fact, penetrate the oversupplied international coal market. Major expansions were anticipated in the future.

48. Finally, it was emphasized that the exploration and use of coal causes certain environmental impacts which must be controlled, mitigated and, in the case of open-pit mining, restored. The early introduction of fluidized bed combustion in (low pressurized)

small powerplants appears to be a favourable solution. The experiences of African countries where such technology has been introduced should closely be observed.

The Situation of the Electric Energy Supply and Demand during 1972-1982 and the Future Perspectives in Africa (Agenda item 7)

49. The secretariat apologized to the participants of the Workshop for inability to present this paper which was expected to be produced by the staff member, who was recently transferred from the ECA headquarters.

Evaluation of Energy Demand in Developing Countries: the MEDEE-S Model (Agenda item 8)

50. He stated that inspired by the MEDEE approach, the MEDEE-S model was developed to evaluate energy demand in developing countries. It is technico-economic accounting type model whose logic is akin to that of MEDEE-2. Nevertheless MEDEE-S was conceived in a very different way and it was completely rewritten, drawing on the experience gained from the previous models and using an analysis of energy demand determinants from various developing countries.

51. In MEDEE-S the approach in terms of useful energy was not systematic and was only used for substitutable uses. To understand this, one should recall the two major reasons which led to the introduction of useful energy into accounting models: i.e. to measure the impact of the energy substitutions of energy sources with different efficiencies on consumption levels, and to take into account improvements in efficiencies. Efficiencies gains could be taken into account directly at final energy level for non-substitutable uses and therefore is seemed superfluous to resort to useful energy.

52. The evaluation of useful energy was rarely made in absolute value when dealing with substitutable uses but rather in relative value - called "pseudo-useful energy" - which in essence was the same thing. The evaluation of energy consumption in terms of useful energy was a delicate process for numerous end-uses (cooking, lighting, industrial uses); the definition itself of useful energy often being ambiguous and the useful energy difficult to measure (for example difficulties in measuring efficiencies). This approach to understanding useful energy had been used for many years in India where coal is taken as the reference energy and the "pseudo-useful energy" measured in "ton coal replacement".

53. This type of accounting model should not be the final objective of energy demand evaluation and forecasting, but slowly as the data become satisfactory and the major issues have been identified through alternative and constructed scenarios, the model should be enriched so as to integrate endogenous procedures which simulate the behaviour of households and industry with respect to their technical and energy choices. Then we come up with a systemic model of the MEDEE-3 type, which implies a careful analysis of the behaviour of economic actors and, more generally, of the dynamics of changes in energy demand determinants.

54. One of the participants to the meeting observed that MEDEE-S model could be of interest to African member States, however, the principle of energy modelling should be thoroughly discussed before its actual application. In some particular country modelling led to the conclusion that a certain type of stove should be introduced, however, in real life this proved to be impossible. So the situation is that modeling for the sake of exercise could not be expected.

55. One of the participants commented that MEDEE-3 model was enhanced during the last years and this model was especially tuned for the requirements in the developing world. But model is good when the input is full and comprehensive and model should be written for computers of specific type. But this model could be useful for long-term projections rather than for short-term.

Consideration of the national papers and papers prepared by International Organizations (Agenda item 9)

56. The representatives of the UNECA member States as well as some international and intergovernmental organizations presented to the meeting highlights of their reports on the state of energy situation and energy supply and demand forecast which are summarized in this report in the order of presentation to the meeting.

Lesotho

57. With the exception of large, as yet untapped hydropower resources, Lesotho has no domestic commercial energy resources. As a result the country meets its commercial energy requirements through importation. Imports include refined petroleum products electricity, coal and fuelwood.

58. Total energy demand in 1981 amounted to 14 PJ. With a total population of 1.1 million people living within the country, per capital consumption amounted to 12.7 GJ. About 57 percent of the total energy consumption was met by non commercial fuels such as fuelwood, shrubs and dung. As for the commercial energy sources, petroleum products made for 20 percent, coal for 15 percent and fuelwood for 5 percent of the energy balance. Electricity accounted for only 3 percent of the total energy consumption.

59. Lesotho has already embarked on the first step in energy planning which is data collection. The data will be stored in a computerized energy information system and will be used to draw-up energy balances under the subdivisions primary energy availability, energy conversion, and end use.

60. The steps which will then follow in the planning process are demand projections, supply analysis, evaluation of energy resources and supply technologies and finally construction of projected demand/supply balances.

61. However, for illustrative purposes, a preliminary energy demand projections which was prepared by a World Bank team is as follows:

Projected Commercial Energy Demand ('000 TOE)

Source	1981	1985	1990
Petroleum Fuels	65.4	78.0	101.0
Electricity	29.3	35.0	52.2
Coal	49.1	56.6	67.6
Total	143.8	169.6	221.1
Growth percentage per annum		4.2	4.9

Source: World Bank/UNDP Mission estimated

Ghana

62. Ghana produces the bulk of all its refined products needs in the CHARIP refinery in Tema (1.25 M Tons/yr). Ghana's per capita oil consumption was estimated at 81 KOE in 1981, though it reached 88 KOE in 1975.

63. The Volta River Authority (VRA) is responsible for generation and transmission of electrical power in Ghana. The VRA operates two hydroelectric generating stations with a combined installed capacity of 1060 MW and a 161 kV transmission system. The generation system is made up of Akosombo hydro-electric generation station (912MW) and Kpong Hydro-electric station (148 MW). The users of power are VALCO, ECG, the Mines, Akosombo Textiles and AK-Township. Only 25 percent of available energy is currently required to satisfy the domestic market. The remaining energy is used to support VALCO and for experts. More than 95 percent of the households in Ghana use wood or charcoal as their main cooking fuel. Wood also provides a sizeable proportion of the energy in agriculture and small-scale commercial enterprises.

64. Ghana does not suffer from deforestation, and is not likely to face the sort of forest depletion problem that is threatening other countries, although regional scarcities do occur in the extreme north-eastern part of the country. Fuelwood demand will therefore, not, in most cases, be limited by supply constraints.

65. Normally, the share held by non-commercial energy (e.g. fuelwood, charcoal) is mostly independent of economic growth but is directly linked to population growth. Charcoal and fuelwood uses are therefore expected to increase over 1985-1990 to meet the requirements of the residential and commercial sectors. Assuming a population growth rate of 3.1 percent per year over 1985-1990 and using 1981 as base case the projected consumption/demand of non-commercial energy (fuelwood and charcoal) is calculated. Whilst consumption figures for 1983 and 1984 are not yet available any forecasts based on them

could be misleading since consumption of fuelwood and charcoal in these years was high due to shortages of kerosene, LPG and electricity for residential and commercial uses.

66. The forecast of energy supply and demand in Ghana to 1990 was done by sectors and numerous tables illustrate the findings of the authors.

Habitat

67. The representative of Habitat presented the report which dealt with various aspects of energy consumption by and energy requirements of the low-income population in urban and rural settlements in developing countries. It also discussed the technological options available to meet energy needs in the domestic sector, the potential of renewable energy resources and institutional and financial issues relating to the utilization of renewable energy resources in developing countries. The emphasis of the report was on the implications of introducing certain energy systems into rural and low-income urban settlements and on policy options for supplying energy needs in the domestic sector.

68. In relation to Africa, which was the focus of the workshop it was noted that fuel wood was used for over 90 percent of primary energy needs in the continent, and that annual per capita consumption of wood fuels was about 1.5 cu.m. It also noted that the growth rate of fuel wood and charcoal consumption in Africa during 1961 to 1975 was 2.2 percent.

69. In spite of a sharp increase in oil prices with a projected doubling of oil prices in real terms by the year 2000, petroleum products would continue to play a central role in the economic development of most countries. It stated that for all non-oil producing developing countries, consumption of energy was projected to grow by 6.2 percent/p.a. during the decade from 9.65 million barrles p/d in 1986 to 17.75 million barrels p/d in 1985. It was also indicated that the net energy imports of the oil-importing countries was projected to rise from 3.2 million b/d in 1976 to 4.3 million b/d in 1985 - all in the form of oil.

70. Other commercial energy sources such as coal were discussed and observation made that the problem in most of the countries with coal reserves was not necessarily one of identifying new coal fields, but one of knowing the extent and quality of existing resources.

71. The potential of some renewable energy sources such as solar energy, wind energy, hydropower, biomass, etc. were discussed and suggestion made that given the current profiles of oil-based economy to one less dependent on oil, as well as to ensure an adequate and uninterrupted supply of energy to the domestic sector, it would be necessary to consider increased investments in and more efficient use of these renewable energy sources most of which are at present, largely undeveloped. The Habitat representative concluded that although the renewable sources of energy now played a very limited role globally, their importance at the local level should not be underestimated.

Organization of African Unity (OAU)

73. The representative of OAU secretariat stated that energy in Africa plays a large and important role as it was one of the means for intesifying national development, modernizing agriculture, attaining industrialization, and improving the living conditions of the expanding population in the rural areas. To-day energy has become a critical element in the African economy for which there is a growing energy demand and an uncertain long-term supply.

74. New and renewable sources of energy, such as geothermal power, solar, wind, biomass and biogas energy were available widespread and attractive to develop and could make a valuable contribution to energy supply in the future.

74. He emphasized the gravity of present crisis, and said that various schemes already have been undertaken to reduce the oil dependence of non-oil producing countries, including tapping alternative sources of energy. Although both developed and developing countries are confronted with problem of energy; the developing countries were suffering more, due to their low level of economic activities, which in turn impeded their development.

75. In conclusion, the representative of OAU secretariat reiterated that there was a pressing need, in African countries for specialists in the energy fields to improve the efficiency of energy use, to develop locally available energy resources, to introduce appropriate alternative technologies, and to have enough knowledge of energy demand and supply to launch appropriate energy policy and planning programme.

IEA

76. The representative of IEA apologized for not being in a position to present the paper due to the late notice about this Workshop. He briefly outlined the major tasks of his organization and informed the meeting that IEA would in 1986 embark on the study of the energy problems in Africa and Asia. The set of recent publications on IEA activities was presented to the ECA secretariat and the representative of IEA expressed the willingness of the Organization to supply African member States (on request) with published materials.

EUDA

77. The representative of EUDA emphasized that under its energy programme his institution was participating in an International network conducting research into new methods of analyzing and predicting energy requirements and supplies in Third World countries. The network is supported by the Directorate-General for energy in the Commission of the European Communities.

78. ENDA has also organized two training programmes for senior energy planners which continued through 1985.

The representative of ENDA then outlined the basic principles of methodology employed by his Institution for projecting energy supply and demand in the developing countries.

79. The proposed method is composed of five successive stages which should be coordinated and executed integrally. In that case a cycle of iteractions is created which should be pursued until the final results are obtained.

80. The five stages of the process areas follows:

a) Definition of the terms of reference of the energy system;

b) Provision of needs;

c) Provision of the demand;

d) Adjustment between needs and demand;

e) The impact of the awaited evolution of the energy system on environement, social, economic and cultural system.

81. The first stage is diagnostic and intended for identification of socio-economic, cultural, aspects of energy, forecasting for defining of the socio-economic scenario.

82. The following three steps which constitute the methodological core of the approach lead to determination of the evolution of the energetic system, on one side, the regard of the needs and the demand on the other and the equivalent ones as well. The fifth and the last stage is determined to examine the consequences of this evolution and to control the coherence and the realistic hypothesis of the beginning of the socio-economic scenario. Thus, through the successive iteractions, the method allows to obtain the global results giving the desired evolution, which could be defined as probable or possible energy system.

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83. Inspite of its vast natural resources, Africa remained the least developed continent in the world in terms of all significant economic indicators. Presently the majority of the African countries, especially those of the sub-Saharan region, must be classified as "least industrialized countries".

84. Taking into account that energy is one of the major factor inputs to industrialization UNIDO is presently undertaking a survey aimed at providing a better understanding of the energy requirements for industrial development and to identify appropriate technical assistance projects within the programme of the "Industrial Development Decade for Africa" (IDDA). The paper summarizes some of the results of the survey and of the conclusions drawn for a more detailed study, especially for improved energy planning for industrial development.

85. For the data collection and assessment of the available information, three major sources were used, namely the UN Statistics, the UNDP/WB Energy Sector Assessment Reports, and the Commission of European Communities (EEC) study on energy for development done by the established "network of energy institutes".

86. The results of the survey are illustrated in a total of 12 tables and 12 figures, indicating the major constraints of the present and future energy situation in Africa and its implication for industrial development.

87. The results obtained of the survey have identified the major directions of the proposed study, namely:

- specific emphasis must be given to the development of the rural areas, representing 75 percent of the population, as the starting point for economic development;

- the development of the small-scale industries is of specific importance for sub-Saharan Africa. Their production processes presently rely mainly on human and traditional energy. The introduction of mechanized technologies is the most important step towards increased productivity. It requires commercial energy in form of final energy specially electricity;

- the low level of electrification is one of the major inhibitors of the industrialization process;

- the development of the electrical sector requires a rational energy policy taking into account the available human, physical and financial resources and the global development trends;

- hydro-power and to the extent possible coal-fired plants, are the most important energy sources for improved electricity generation in sub-Saharan Africa.

88. From the supply side, independent Africa has a large unutilized potential of energy sources. The only energy resource presently overutilized is fuelwood, accounting for about 80 percent of the total energy consumption in sub-Saharan Africa.

89. Only well defined structural changes can satisfy the commercial energy demand for industrial development. These structural changes require a long-term integrated industry and energy policy, not only at the national but also sub-regional level.

90. The major problem for the development of long-term policies is, however, the lack of reliable and accurate statistical data of the energy-related industrial sector including traditional energy.

91. The major directions of the proposed study, co-ordinated by UNIDO in co-operation with other organizations regional and national organizational are as follows:

1. to develop direct contacts with national and regional African organizations to assure the provision of reliable and accurate input data on the basis of normalized industrial energy balances;

2. to develop a common methodological framework for integrated long-term energy policies. At present most of the available methodologies and tools are not or are only partly applicable to the specific situation of the sub-Saharan region;

3. to establish a number of case studies in close co-operation with selected countries with different development stages. Such case studies should not only verify the data sets and the adapted methodologies but should initiate in-depth decision oriented planning activities at the national level. The training of the national team actively contributing to the study must be an essential element of the co-operative programme.

Summary

92. Africa has substantial reserves of oil and gas and produces substantial quantities of these. But African oil and gas are as yet more significant as foreign currency earners than they are as sources of energy. Over 80 percent of African oil production is exported to earn hard currency. While they are important as energy sources in the countries that produce them, they are more important as foreign currency earners and are likely to remain so into the 1990s even with concormittantly increasing local consumption. There are more than sufficient potential reserves to enable increase in supplies of oil, given favourable international oil market situation.

93. Taking Africa as a Region (excluding South Africa), the continent consumes more coal than it produced in the 1980-1985 period and this pattern is projected to continue into the 1990. Intra-African trade in coal seems to be more established in the continent than other commercial energy sources, such as oil and gas. Moreover, there is a net import of coal into the continent, a situation that is projected into the 1990s inspite of its increasing production by the continent.

94. Woodfuel is used for over 90 percent of primary energy needs in the continent. Annual per capital consumption of this fuel is about 1.5 cu.m. The rate of growth of fuel wood and charcoal consumption in Africa during 1961 to 1975 was 2.2 percent.

95. Estimates of reserves of non-commercial energy sources such as fuelwood, charcoal and bagasse ranged widely and are not presented in this study. It should be noted that the energy consumption pattern in rural areas is marked by the very high share of non-commercial (traditional) and the exceptionally low share of commercial sources of energy. Geothermal and solar energy may offer a partial solution to the energy problems in rural areas in some African countries.

96. Although Africa has vast resources of hydropower only a small fraction of it has been exploited to-date. In the last few years, however, the production of electricity registered a substantial growth. Thus, in 1980, the continent produced 188,418 million Kwh, and in 1983 production reached 211,421 million Kwh.

97. For the majority of African member States incapacitated by the cost of oil imports, investment in energy remains an absolute priority. It is a well-established fact that the poorest purchasing countries in Africa can no longer afford their oil. They have to allocate up to 60-70 percent of their foreign exchange resources to pay for it. An energy policy should be designed therefore, in such a way as to balance external accounts in order to maintain growth.

98. A periodic review of an energy balance sheet must be undertaken in order to ascertain what the energy policy involves in terms of cost and return, as compared with other investment possibilities. Every energy policy necessarily involves a periodic comparison of the main long-term investment possibilities that exist for promoting national development The final choice is a purely political one and specific to each African country.

Consideration and adoption of the recommendations and final report of the Workshop (Agenda item 10)

99. The Rapporteur presented to the meeting a set of draft recommendations elaborated after the debate, on behalf of the Committee on Recommendations. After considering and amending them, the participants to the Regional Workshop on Energy Planning in Africa adopted the recommendations, which appear in Part Three of this report.

100. After considering and amending the draft report of the Workshop presented by the Rapporteur, the meeting adopted it.

Any other business (Agenda item 11)

101. There were no issues for discussion under this item.

Closure of the Workshop (Agenda item 12)

102. Following the adoption of the final report and the resolutions, the Chairman declared the Workshop on Energy Supply and Demand Projections through 1985-1990 closed. On behalf of the participants, he expressed his appreciation of the work done by the ECA secretariat which permitted the successful outcome of the Workshop.

PART THREE -- Recommendations

Preamble

1. Energy supply and demand forecast both long and short-term have become an urgent necessity for African countries, since high energy costs or supply inadequacies jeopardize the entire prospect of continuing development. The high-priced imported energies have disastrous effects on their balance of payments and on their rates of inflation and economic growth. The pace of economic development cannot be sustained in the face of high energy prices.

2. The main limitations on economic growth in some African countries are the difficulties of mobilizing capital for energy investment and the difficulties of importing commodities and energy equipment not produced locally. The lack of management skills also plays a major role.

3. Problems of capital supply and inadequate foreign purchasing power are likely to becom aggravated, since most of the promising substitute energy sources are capital intensive and many of them will require imported technologies, and operating costs with high foreign currency involvement.

4. Regarding energy supply options, the African countries confront the special problems of significant dependence on traditional energy sources. Most technologies aimed at managing other and especially new and renewable energy sources supplies involve substantial capital expenditures, and difficult changes in institutions and socio-cultural patterns. For some of them, the lack of advanced infrastructure, technological and management skills may be a serious disadvantage.

5. These remarks refer to the complexities of effective energy planning-complexities of a political as well as of technical and economic character. As a complex, not a single all-embracing remedy, of responses is called for, every African developing country faces major issues of working out patterns of energy supply and use, compatible with its basic resources and its development aspirations.

6. The consequences of inadequate management in either the short or long-term may negatively influence economic growth prospects and social and political stability. Nor can long-term problems be differed until those of the short-term are fully resolved. The lead times inherent in altering the basic character of the energy regime may result in costly penalties for failure to start as soon as possible. Therefore, the development of a comprehensive energy strategy as well as its implementation has now become an imperative for African developing country governments, not as an isolated exercise, but as an integral part of their general economic management.

7. The diversity of resource endowment and development conditions is so great that no common strategy could be appropriate for all countries. But one can suggest a series of broadly applicable suggestions for increasing energy supplies to replace imported energy, for improving energy efficiencies and fitting energy into broader development objectives. In this framework subregional and regional co-operation deserves special attention.

(a) Energy demand

8. Energy demand policies should promote the rational utilization of energy and consumption patterns that aim to increase reliance of African countries on indigenous energy sources. It is, therefore, recommended that all available economic, technological and administrative measures for energy demand management be applied without inhibiting economic development. Development strategies that are more energy effective and rely on indigenous energy sources should be encouraged. It is important to identify the main energy-using sectors and investigate in a preliminary way those possibilities of saving energy which can be achieved without major economic disruption.

9. The analysis and assessment of energy demand in African countries should take into account the co-existence of the traditional and modern sectors of the economy in the country. Criteria of cost effectiveness and social benefit may have to be weighed differently for these two sectors. There is clearly a conflict in pricing policy between economic efficiency and equity. This conflict will not be resolved easily, and compromises will certainly have to be made.

(b) Energy supply

10. The energy supply strategy in Africa should encourage the development of indigenous resources, both conventional and non conventional. For this purpose, a comprehensive assessment of potential supplies can help to identify some of the most promising resources options. Where indigenous resources are inadequate, possibilities of substituting cheaper imported energy for oil deserve serious consideration.

11. Because of uncertainities of future energy supply, due consideration should be given to the promotion of energy self-sufficiency of member States in order to reduce dependence on imported energy, but should not seek energy self-sufficiency regardless of cost. Energy plans should take into account the long lead times usually associated with energy supply schemes and provide for contingency measures against possible sudden disruptions of supply.

12. The potential contribution of non conventional sources of energy to meet energy requirements of African countries should be realistically assessed, giving special attention to its role for energy supply in rural areas by means of small-scale technologies genuinely appropriate.

13. In the above regard, countries should explore the development and greater investments on some renewable sources of energy such as - solar energy, hydropower, biomass and wind energy, etc.. . Given the current profiles of oil and gas energy supply and consumption patterns, and in order to reduce dependence on oil as well as to ensure adequate and uninterrupted supply of energy to the domestic sector, increased investments in substituting energy sources and more efficient use of new and renewable energy sources would be strongly advised. Energy planning in Africa must give very high priority to research and application of rational solutions aimed at arresting the self-destruction of basic resources edowment such as water, plant cover and soils.

14. As a general rule, domestic energy pricing should reflect the opportunity cost of investment in the particular economy. It may be necessary, however, to take account of social objectives and modify prices to suit the needs of the end user.

(c) Energy planning

15. Energy planning must be part of the broader process of economic development planning, and this requires intensive research and a high degree of flexibility because of the ever changing energy situation in the African countries and the world at large.

16. Energy planning must also take into account major technological break through which may drastically change the expectations and plans for future energy sources, bearing in mind that the development of most of the new technologies or energy sources, require a long lead-time before large-scale commercial production can be realized.

17. Energy plans should establish energy production and utilization objectives for the short, medium and long-term, define the strategies to be followed and the resources to be committed, and propose the necessary legislative and administrative action for moritoring implementation.

18. The national planning system and related planning institutions in African member States should stimulate broad and effective participation of all concerned sectors in policy formulation and implementation. Depending on circumstances in each country, central responsibility may be placed in a national energy agency, a division within an existing ministry, an institution for energy planning, or a national committee supported technically by existing institutions.

19. In the African countries, energy policies and planning must take into account the socio-economic duality created by the co-existence of modern and traditional sectors. This duality is characterized by different patterns of energy consumption and supply: in the modern sector, life style and technologies resulting in energy use mostly based on petroleum: in the traditional sector, a subsistence economy based on low-energy intensity, dispersed demand and supply, but an often threateningly high consumption of limited fuel-wood resources which leads to accelerated degradations of the ecosystem.

20. Health and environment effects must be monitored, even in countries with little development and many untapped natural resources, if future development were not to produce unwelcome environemental consequences.

(d) Methodology of demand and supply projections

21. There are a number of ways of organizing this process. The country should determine its needs and appraise the available energy resources and at the later stage to organize the short, medium and long-term planning programme for the development of these resources.

22. In formulating energy plans, available analytic tools, such as energy balances, energy surveys and energy models, should be used. Great care is required, however, to adjust these tools and methodologies to the nature of a country's problems, but they should not be used as a substitute for human judgement and experience.

23. It should be borne in mind that any projections of energy supply and demand at such a regional level as Africa is so aggregate as to mask subregional and individual country variations in such supplies and demands. Individual countries therefore, would have to make their own more definite projections given their particular circumstances of energy supply and demand and constraints.

24. The general unavailability of adequate energy supply and demand data on country basis and by energy sources or types makes any projections only tentative and indicative, particularly so at the Africa regional level.

25. It would be imperative to set up national and regional energy information system that would provide data, technical and economic information for energy planning and energy resources development in Africa. These systems could include some publication that would be issued periodically to provide a vehicle for the dissemination of information on energy planning methods, practices and results.

26. The ECA secretariat is requested to prepare a technical publication on methodology of energy supply and demand forecasting and submit this to the member States at a later stage. ECA should co-ordinate collaboration of member States with organizations like ENDA, Habitat, UNIDO, IDRC, who are involved in developing methodologies and models and should assist in dissemination of this information.

(e) Financing

27. Energy supply and demand forecast become operationally meaningful to the extent that energy projects can be adequately financed. Therefore, the member States should allocate the necessary funds for implementing energy development projects. Given the shortage of capital and balance-of-payments difficulties prevailing in African countries, it is essential to have concessional financing so that indigenous resources, like petroleum, natural gas, and coal can be developed without negating socio-economic goals.

29. Multilateral and bilateral agencies providing financing for energy projects and programmes should act in support of national energy policies of African member States.

(f) Manpower

29. Proper and systematic development of manpower resources for energy supply and demand forecast and plan implementation must be encouraged at all levels. On-the-job training courses in energy planning in general should be carried out as much as possible within the country, supplemented by training support from abroad as well as subregional and regional exchange of experts. The goal of this training must be to achieve the highest possible degree of self-reliance in dealing with energy planning, energy supply and demand forecast, utilization and policy formulation.

30. To reduce the drain of qualified manpower that affects many African countries, better working conditions such as adequate salaries and incentives should be offered to local personnel so that they may use their skills for the benefit of their own country.

(g) Subregional, regional and international co-operation

31. Priority should be given to energy supply and demand forecast at the national level. However, national energy planning cannot be undertaken in isolation. While all countries should strive for reasonable self-reliance, the nature of an interdependent world demands co-operation and co-ordination with neighbours in the subregion.

32. In view of the advantages of the economies of scale and of integrated systems, regional and sub-regional co-operation between Member States should be encouraged. Joint projects should be promoted wherever technically and economically justified. Regional co-operation could also extend to the exchange of information and experiences on energy supply and demand forecast.

33. Effective and co-ordinated international co-operation in the energy sector should be promoted to enable African countries to improve their capability to analyze their energy situations and to establish and implement effective energy development policies and strategies. Such co-operation should include inter alia training, institution building and the development of appropriate tools for energy planning, and supply and demand forecast.

34. Intercountry trade in energy within the region is very limited. The result is that while on a "global" level, Africa exports much energy, many individual countries suffer energy shortages. This is an essentially economic and political problem which is best addressed on a bilateral as well as multilateral contexts. The ECA and the OAU

are institutional frameworks for attending to such problems. It should be possible in many cases to work out mutually acceptable formula that would enable oil producing African States to meet some of the oil-supply demands of African non-oil producing States.

(h) Policy and strategy suggestions

35. The gravity and urgency of energy issues in Africa and the magnitude of the necessary structural adjustments require greater attention of member States to clearly define policy and strategy in energy planning, pre-investment studies to formulate better strategies for energy supply and demand forecast and the mobilization of financing for the implementation of energy projects.

36. In the implementation of all these recommendations, it is understood that the basis for all these are the guidelines contained in the Lagos Plan of Action and the Final Act of Lagos. In addition, the Nairobi Programme of Action on new and renewable sources of energy contains useful guidelines.

Distr.:
LIMITED/LIMITEE

ECA/NRD/ESDP/Inf.2/Rev.1
28 November/novembre 1985

Original: ENGLISH/ANGLAIS
FRENCH/FRANCAIS

ECONOMIC COMMISSION FOR AFRICA

Regional Workshop on Energy Supply and Demand Projections through 1985-1990 in Africa

Addis Ababa (Ethiopia), 25-29 November 1985

COMMISSION ECONOMIQUE POUR L'AFRIQUE

Séminaire régional sur l'offre et la demande d'énergie, projections pour les années 1985-1990

Addis-Abeba (Ethiopie), 25-29 novembre 1985

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